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Complete Specification Left, 15th July, 1909—Accepted, 13th Jan., 1910

PROVISIONAL SPECIFICATION.

"Improvements in and relating to Wind Turbines."

We, JOSEPH GERSHOM CHILDS, of Hawthorn Road, Willesden Green, London, N.W., and THOMAS SIDNEY HILL, of 80, Harvard Court, West Hampstead, N.W., both Electrical Engineers, do hereby declare the nature of this invention to be as follows:—

This invention relates to an improved device for controlling the position and operation of a wind turbine wheel with respect to the direction and velocity of the wind. Heretofore as is well known, the wheel has been brought into the appropriate position by means of an auxiliary wound wheel and gear, or a vane attached at right angles to the plane of the wheel, and provisions have been made for swinging this vane about an approximately vertical axis, so as to make it lie close up against the wheel when it was desired that the wheel should be brought out of action. According to the present invention the wheel is put out of action by rotation of the controlling vane, not about a vertical axis, but about a horizontal axis; for by causing the vane to present its edge to the wind its controlling effect is immediately nullified.

In one form of construction according to the invention the wheel is mounted as usual upon a shaft secured in a casting capable of rotating on a vertical axis, which axis however does not as a rule pass through the shaft of the wheel. To this casting there are secured two or more approximately horizontal rods or shafts which are supported in bearings carried by a suitable framework attached to the casting. Upon each of these shafts is mounted a vane. One of the shafts is fixed in its bearings so as to be incapable of rotation, while the other is free to turn. The shafts are inclined to one another at a suitable angle, say about 140°, and the bi-sector of this angle is approximately at right angles to the plane of the wheel when the vanes are in operative position, *i.e.*, the vanes are approximately symmetrical with respect to the wheel shaft. When the wheel is at work the vanes lie in the vertical plane, and the resultant effect of the two vanes keeps the wheel at right angles to the wind. The movable shaft has a crank attached to it which may be operated through a cord from the base of the tower upon which the wind wheel is mounted.

By pulling on this cord the shaft is rotated so that the vane presents its edge to the wind. When this happens the fixed vane alone controls the position of the wheel, and the size and position of this vane are so arranged that the wheel is brought as nearly as possible into an entirely inoperative position, *viz*: the position in which the wind blows at right angles to the wheel shaft. In order to restore the moving vane to its normal position upon the release of the cord it may be suitably weighted, (*e.g.*, by mounting it non-symmetrically on its shaft) or secured by springs or the like. One of the vanes should be of such a size as not only to counterbalance the wind pressure on the other vane, but also to counterbalance the torque resulting from the eccentric mounting of the wheel axle.

It is desirable to provide means whereby the position of the wheel may be controlled according to the velocity of the wind. For many purposes, for example when the wind wheel is driving a dynamo, it is necessary to ensure that a certain maximum of power transmitted from the wheel shall not be

[*Price* 8*d.*]

exceeded; and for this purpose, means are provided for inclining the plane of the wheel to the direction of the wind so that the wheel does not take advantage of the full force of the wind. This end may simply be attained by the construction above suggested. If the movable vane is mounted with a larger portion of its surface below the shaft than above, the pressure of the wind will immediately tend to turn the vane into the horizontal plane. The stronger the wind the more nearly the vane will approach the horizontal. As the movable vane thus becomes more and more turned, the wheel becomes more and more completely under the control of the fixed vane which brings it farther and farther away from the position of maximum output. Obviously any desired means may be used for regulating the resistance of the vane to this motion such as a weight on the cord at the foot of the tower.

In many cases it may be desirable to add a third vane arranged mid-way between the two vanes above described. This will serve to exert a steadying action, and will minimise the effect of any slight errors in the calculations of the area and position of the other vanes. It is necessary that this central vane should move, and therefore its shaft is preferably arranged to rotate with the shaft of the movable vane. The vane may either be central in its axis or in some cases may be out of centre as described above with reference to the other vanes. The two shafts may be connected in any suitable way, *e.g.*, through crown wheels or segments at the adjacent ends, or through cranks and a connecting rod, or through a belt, chain, or any like device. The frame for supporting the three shafts when three vanes are employed, may suitably consist of three tubular or other brackets or the like arranged adjacent to the three shafts and supported from the main casting. At their outer ends these three brackets may be joined by similar bars which will serve to complete the frame and strengthen it. A similar construction can be used for the vanes.

In some cases, particularly with motors built for large powers, it may be inconvenient or impracticable to construct the vanes in one piece and particularly the moving vane. In that case a suitable rectangular frame may be secured to the main casting and within this frame may be arranged a number of vanes. Each of these component vanes will be secured to a shaft rotatable in bearings in the frame, and the shafts will be caused to rotate together by means of cranks and a connecting rod, or any like device. One of the cranks will be connected in the manner above described to the operating handle below. The component vanes will then have something of the nature of a venetian blind. When they are all in the same vertical plane there will be little if any space between them, but by moving the operating handle they can all be brought into a horizontal position, where they will present no effective surface to the wind. One result of the above construction is that a large wheel may be controlled by two comparatively small vanes which protrude on each side of the wheel, without the necessity of providing a long central tail as is usually done; these two vanes would make an angle on each side of about 20°.

Dated this 16th day of January, 1909.

W. P. THOMPSON & Co
322, High Holborn, London, W.C., and at
Liverpool and Bradford,
Patent Agents for the Applicants.

COMPLETE SPECIFICATION.

"Improvements in and relating to Wind Turbines."

We, JOSEPH GERSHOM CHILDS, of Hawthorn Road, Willesden Green, London, N.W., and THOMAS SIDNEY HILL, of 80, Harvard Court, West Hampstead, N.W.,

both Electrical Engineers, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to an improved device for controlling the position and operation of a wind turbine or windmill wheel with respect to the direction and velocity of the wind. Hitherto, as is well known, vanes have been employed which could be rotated by hand or by wind pressure so as to have a different inclination to the plane of the wheel, and thus be caused to set it at a different angle to the wind. It has also been proposed to pivot to the main vane an auxiliary vane normally maintained at a particular angle to the main vane by a weight or spring, but capable of moving to a different inclination under the action of the wind upon itself or upon a third vane mounted on a horizontal pivot on the first vane and linked to the second. It has also been suggested that the blades of the wheel itself should be arranged to turn under the action of centrifugal force, but this arrangement is not good mechanically.

According to the present invention two or more separate vanes are provided, at least one of which is itself pivoted on a horizontal axis, so that the wind pressure upon it can serve directly both to control the position of the wheel and to control the inclination of the vane to the wind. It is obviously desirable that the horizontal axis should pass through the vane, for if the vane were mounted at the end of a long arm extending from the axis, a very large movement of the vane would be necessary to materially alter its inclination.

In the accompanying drawings:—

Figure 1 is an elevation, and

Figure 2 a plan of the head of a turbine to which a preferred form of the invention is applied;

Figure 3 is an elevation, and

Figure 4 a side view of a modified form of vane suitable for the purpose of the invention.

In the form shown in Figures 1 and 2, the turbine wheel *a* is supported upon its shaft *b* which is a little eccentric to the axis *c* about which the whole head turns. The apparatus for controlling the turbine consists of three vanes *d*, *e*, *f* supported on a frame which consists of three pairs of members *g*, joined at their outer extremities by rods *h*. This frame is symmetrical with regard to the wheel *a* its outer members being about 140 degrees apart. The vanes *d* and *f* are supported on shafts *k* and *m* which are revoluble in supports attached to the framing and are inter-connected at their inner end through suitable gearing, *e.g.* two bevel toothed segments *n*, *o*. As may be seen from the drawing the vanes are not attached symmetrically to the shaft, but the larger portion of the surface and of the weight is beneath the shaft in the case of vane *d*, and above in the case of vane *f*. The vane *e*, on the contrary, is not revoluble but is rigidly and symmetrically attached to its frame members. To return the revoluble vanes to their vertical position, a weight *q* is provided as is indicated in connection with the vane *f*, which weight may be adjustable upon a crank *r* secured to the shaft (in this case *m*) of the vane. Means are also preferably provided for rotating the shafts *k* and *m* from the bottom of the wind tower, *e.g.* the crank *r* or another on one of the shafts may be turned by means of a cord or rod extending downward from its end.

When all the vanes are hanging vertically the turbine wheel *a* will be set in the most effective position with regard to the wind so as to take full advantage of it. If the wind increases so that the wheel is able to give out more power than can be well absorbed by the machines to which it is connected, the vanes *d* and *f* will be turned by the wind pressure so as to tend to present their edge to the wind. As they are turned more and more the vane *e* will become to a greater and greater extent the sole controlling device; and the position of this vane is such that, acting alone, it will turn the wheel quite out of the wind.

By this means the wheel will always set itself at such a position with regard to the wind as not to supply more than a given maximum of power, and so can be left to take care of itself even in the fiercest gales. The weight *q* provides a convenient means of adjusting the degree to which the movable vanes turn for a given wind pressure, because it would be difficult to alter the position of the attachment of the vanes to their shafts. When no power at all is wanted, the wheel can be put completely out of action by hand, with the aid of the crank and cord mentioned.

It will be clear that the vanes might be returned to their normal position with the assistance of spring pressure, or if the gearing and suspension were altered by their own weight alone. The spring or weight used may be attached directly to the shaft of the vane or arranged at the foot of the tower.

If desired the central vane *f* may be symmetrical on its axis and rotated merely through the gearing, or it may be omitted altogether. It is useful, however, to exert a steadying action and to minimise the effect of any slight errors in the calculations of the area and position of the other vanes, particularly with large wheels; and it results in the further advantage of a quick response to changes in the wind.

It is also possible to make the vane *e* as well as the vane *d* revolve, the two being connected so as to move always at right angles, *i.e.*, so that the one more nearly presents its face to the wind as the other more nearly presents its edge. The vanes *d* and *e* are so designed that the wind pressure on the one counterbalances not only that on the other, but also the torque resulting from the eccentric mounting of the wheel axle, where such mounting is present, or the reaction of the vertical shaft through which power is transmitted.

In some cases, particularly with motors built for large powers, it may be inconvenient or impracticable to construct the vanes in one piece, particularly the moving vanes. In that case the construction illustrated in Figures 3 and 4 may be adopted, in which the vane consists of a frame *s* mounted upon a shaft or other support *t* and carrying a series of pivoted slats *u* which, when lying in the plane of the frame, present an almost uninterrupted surface. The slats may be pivoted in the frame unsymmetrically after the fashion of the vanes *d* and *f* illustrated in Figures 1 and 2, and for controlling by hand their axes are provided with cranks *v* joined by a common rod *w* and operated through a crank *x* on a rod *y*, which may suitably pass through the centre of the shaft or frame *t*.

The advantage of this construction is that a large wheel may be controlled by two comparatively small vanes which protrude on each side of the wheel so as to be freely open to the wind without influence from the wheel, without the necessity of providing a long central tail as is usually done; these two vanes would make an angle on each side of about 20 degrees with the plane of the wheel.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A device for controlling wind turbines comprising two or more vanes at least one of said vanes being revoluble about a horizontal axis, and at least one vane being fixed, so that the movement of the movable vanes or vane shall alter the inclination of the resultant forces of wind pressure with the plane of the wheel.

2. A device for controlling wind turbines comprising two or more vanes, at least one of said vanes being revoluble under wind pressure about a horizontal axis so as to vary its inclination to the wind and thus alter the inclination of the resultant of the wind forces on the vanes to the plane of the wheel.

3. A controlling device for wind turbines consisting of two vanes, arranged

approximately symmetrically with regard to the turbine, and at an angle to each other, one of said vanes being revoluble on a horizontal axis.

4. In a controlling device according to Claim 3, the provision of an additional central vane revoluble or not as desired.

5. In a controlling device of the type claimed, the use of a vane mounted unsymmetrically, so that its own weight together with the wind pressure control its inclination, substantially as described.

6. In controlling devices of the type claimed the use of a vane in the form of a venetian blind.

Dated this 15th day of July, 1909.

W. P. THOMPSON & Co.,
322, High Holborn, London, W.C., and at
Liverpool and Bradford,
Patent Agents for the Applicants.

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CHILDS & another's COMPLETE SPECIFICATION.

(2 SHEETS)
SHEET 1.

[This Drawing is a reproduction of the Original on a reduced scale]

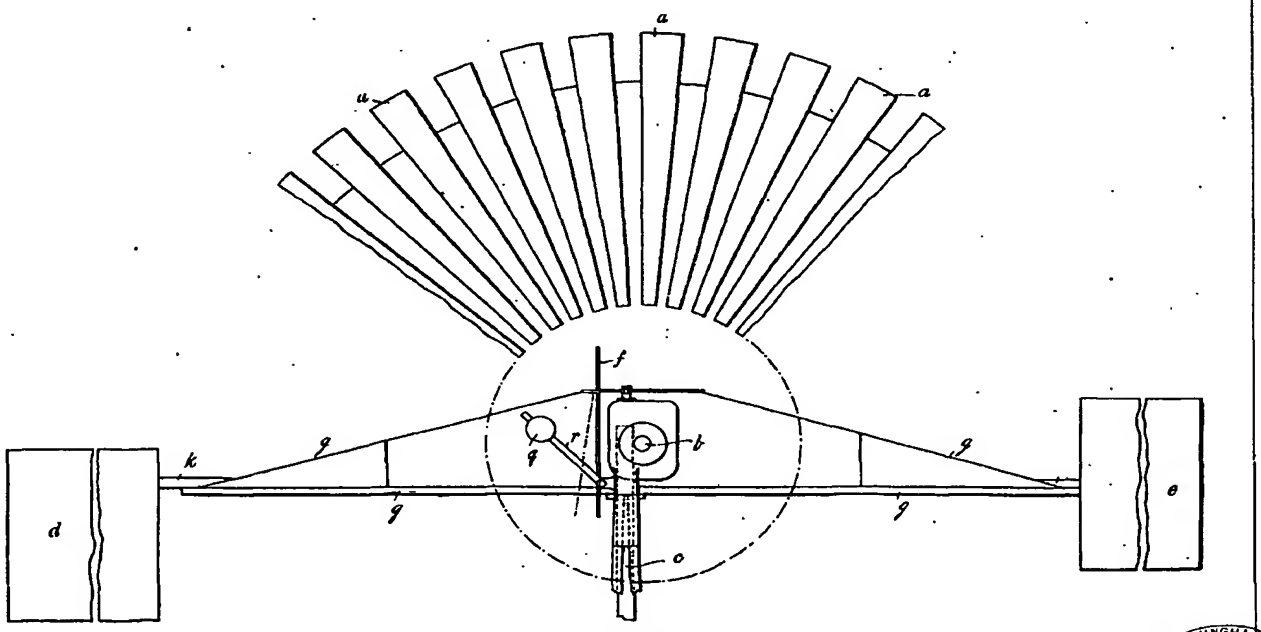
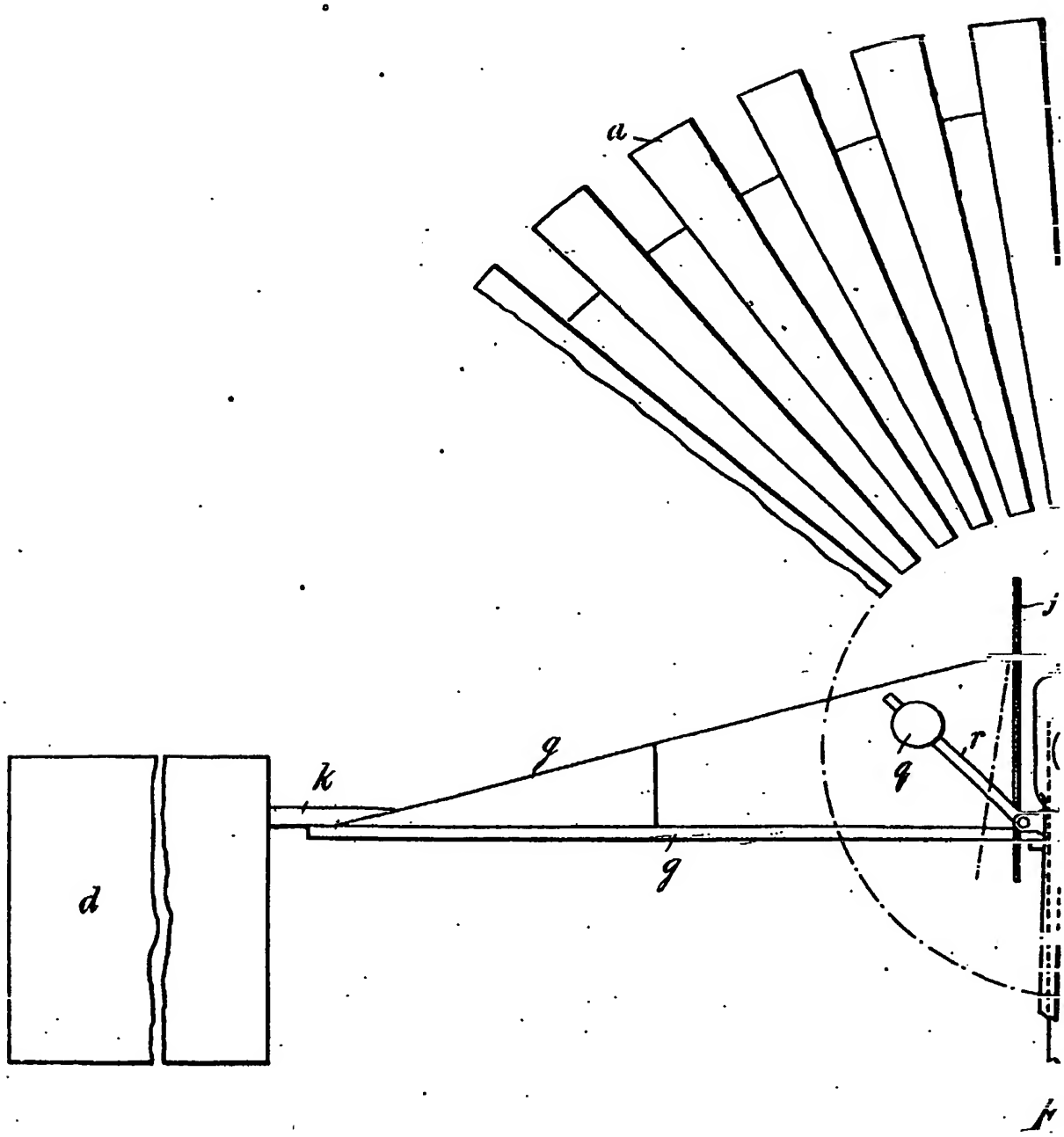
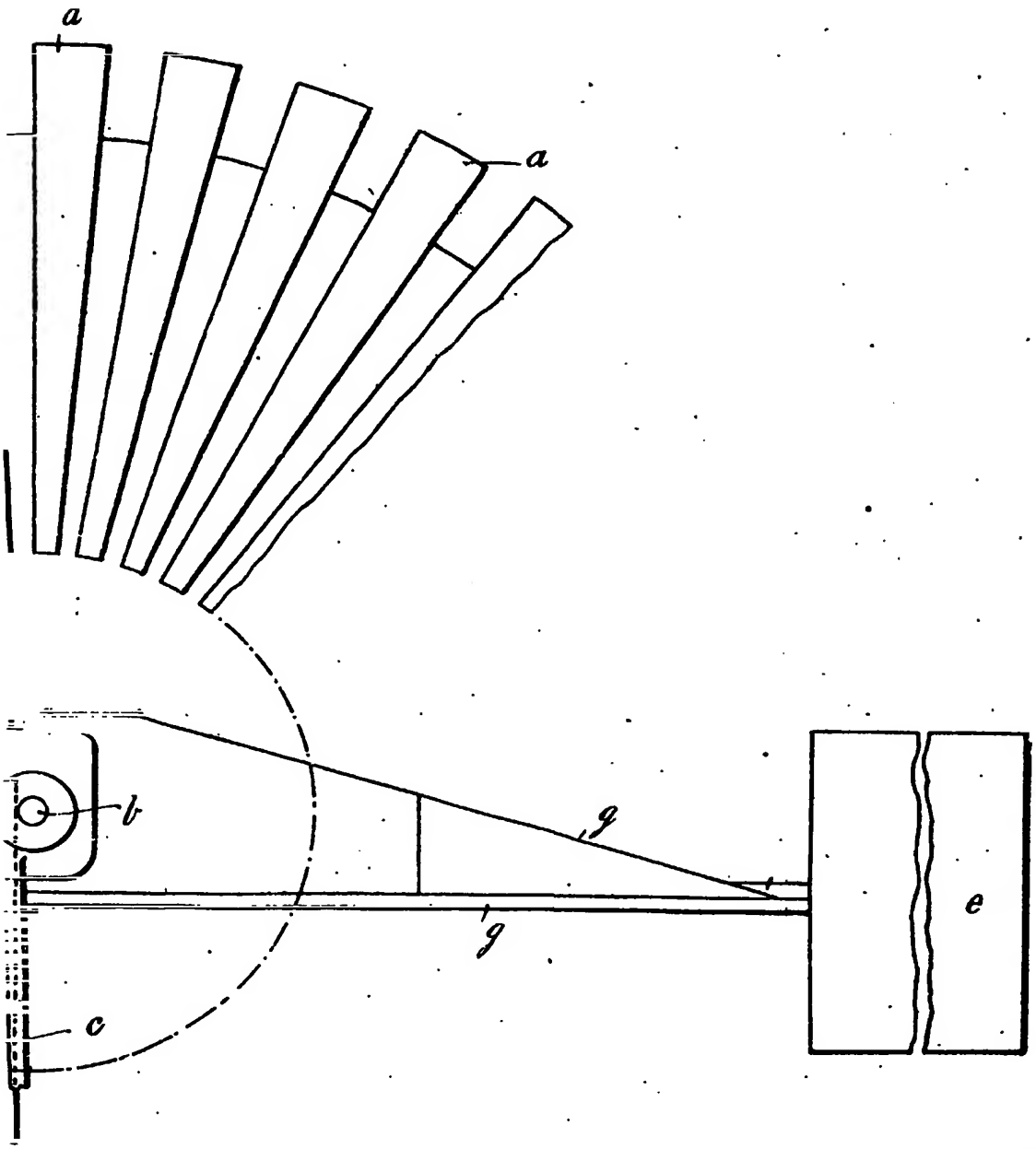


Fig. 1

[*This Drawing is a reproduction of the Original on a reduced scale.*]





g.1

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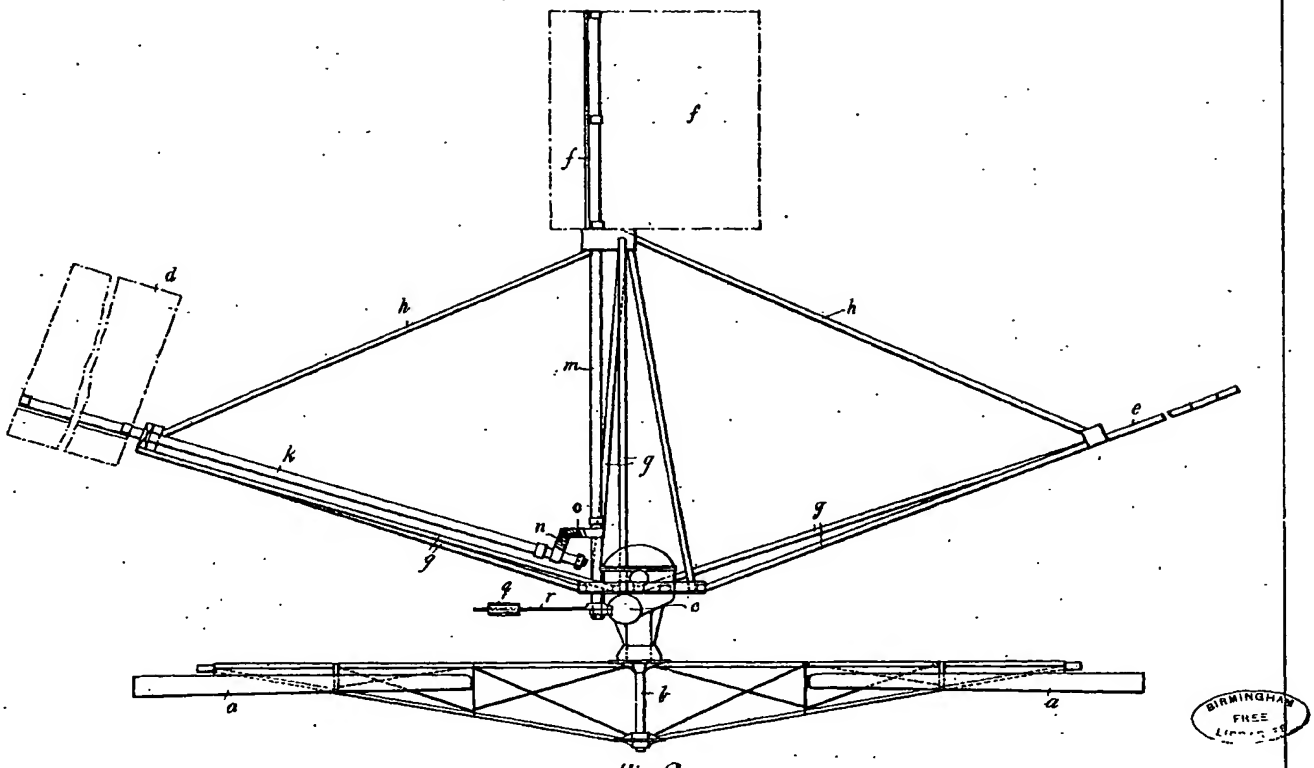

Fig. 2.

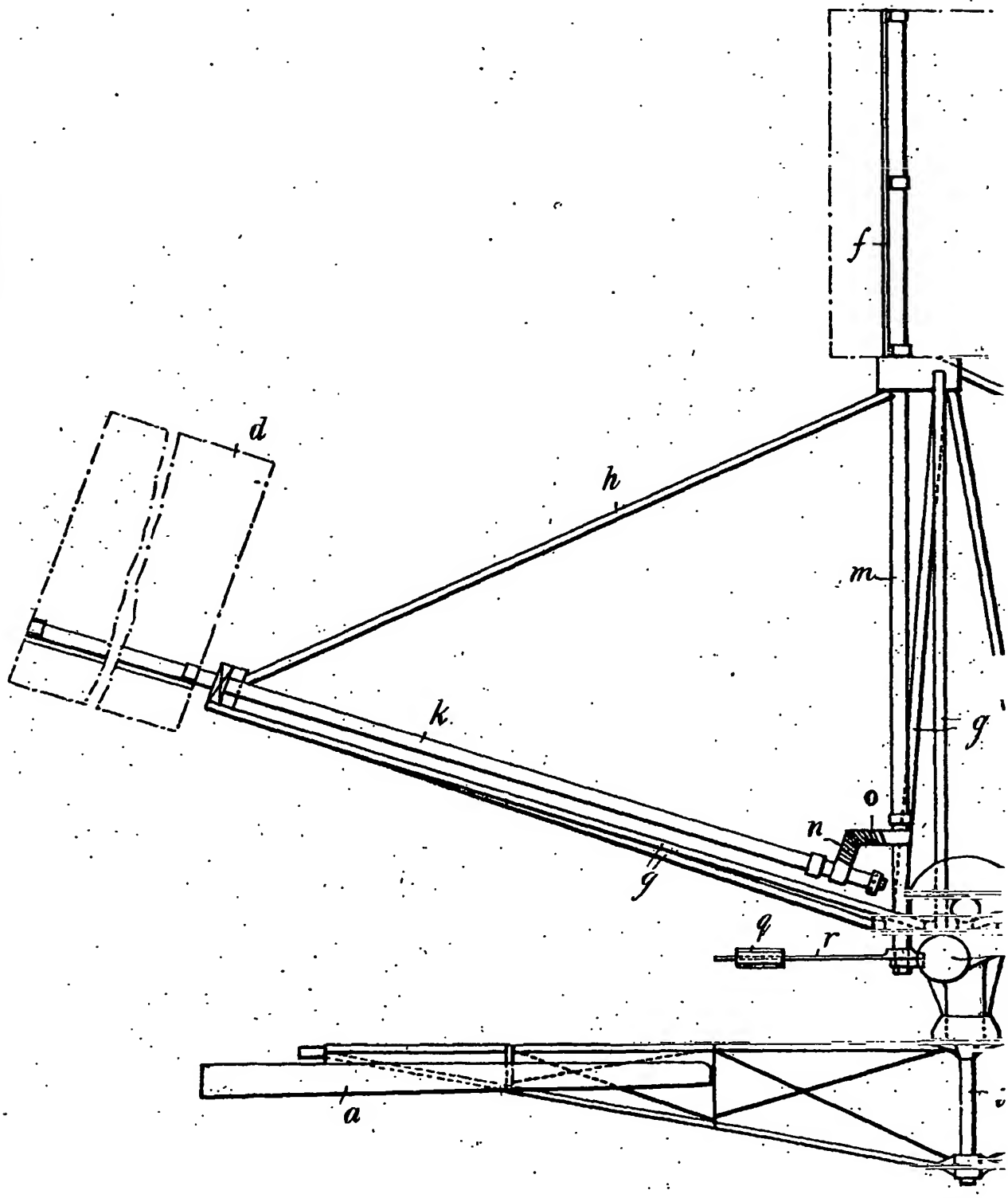

Fig.

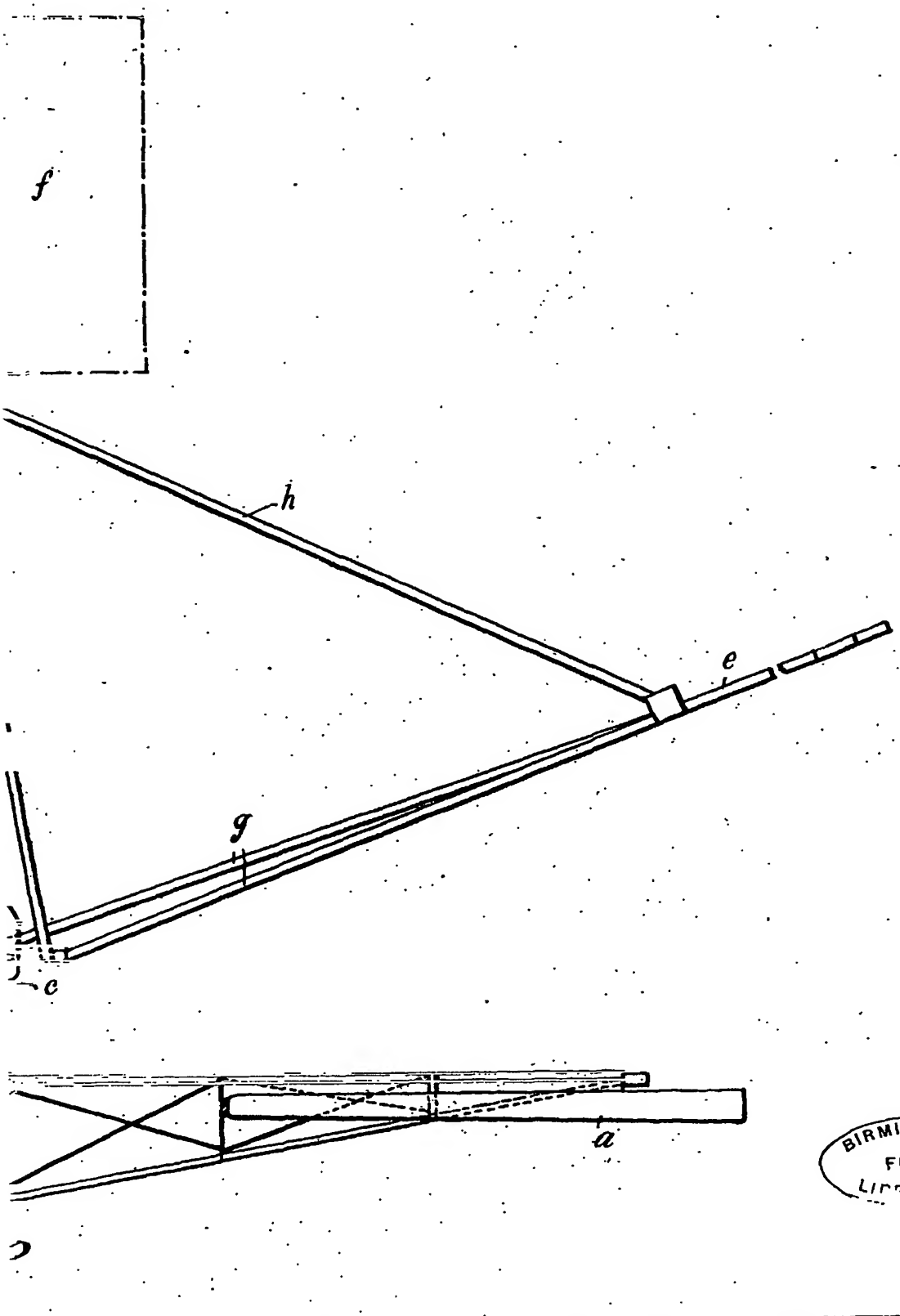

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Fig. 4.

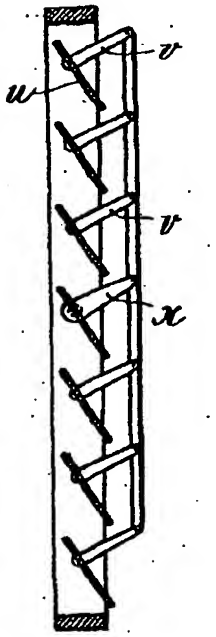
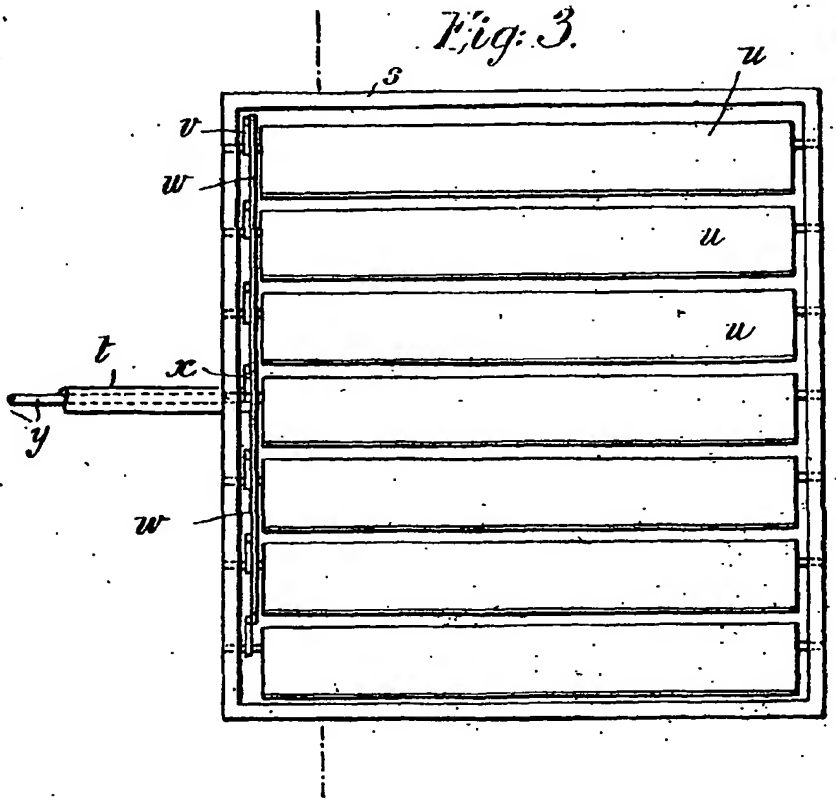


Fig. 3.



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